The Impact of Monetary Policy on Agricultural Productivity and Food Prices in Nigeria: A Time-Series Analysis

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Abdullahi Bashir Muhammed[1]

Abstract

The study examined the impact of monetary policy on agricultural productivity and food prices in Nigeria. The study covered the period of 29 years spanning from 1995 to 2023 which constitutes one hundred and sixteen observations. Data were extracted from the Central Bank statistical bulletin. The estimation technique used was Autoregressive distributed lag (ARDL). The results showed that exchange rates boost Nigeria's agricultural output and food prices in the short and long term. The estimation showed that interest rates negatively affect agricultural productivity and food prices in Nigeria in the long run but positively affect agricultural sector growth in the short term. The estimation showed that money supply reduces agricultural productivity in the short and long term. However, the estimation showed that money supply impacts food prices positively in the short and long term. It was concluded that exchange rate increases or promotes export-oriented agricultural products but has a side effect on imported food or production input. High interest

1. Department of Banking and Finance, Faculty of Management Sciences, University of Abuja, Abuja Nigeria; bash7th@yahoomail.com; https://orcid.org/0000-0003-4218-6846

discourages agricultural technology investment due to higher operating costs, which lowers agricultural productivity and raises food prices. Increased money supply without agricultural investment lowers agricultural productivity and raises food prices. Policymakers should reduce exchange rate fluctuations and create a predictable environment for farmers to invest in productivity-enhancing practices. The government should increase agricultural credit, ensure low-interest loans, and control prices during inflation. To avoid food price inflation and boost agricultural productivity, part of the money supply should go to real sector productivity, particularly agriculture.

Keywords: Monetary Policy, Agricultural Productivity, Food Prices, ARDL

Introduction

Agriculture has traditionally been the backbone of Nigeria's economy, contributing substantially to GDP, food security, and employment. Over sixty-five percent of Nigeria's gross domestic product (GDP) and the vast bulk of the country's foreign exchange revenues come from exports of agricultural products before the late 1950s and early 1960s, when oil was discovered (Okidim et al., 2023). Agriculture accounts for a significant portion of Nigeria's workforce which is about seventy-five percent and contributes significantly to the country's gross domestic product (GDP) (Matthew et al., 2019). In a similar vein, agriculture is the backbone of the food production industry in Nigeria, accounting for close to 80% of the total industry size while forestry, fishing, and cattle production make up the remaining twenty percent of the industry size in Africa (Osabohien et al., 2020). Despite its critical importance, its contribution to GDP has been declining as of late due to low yields caused by farmers' limited access to credit and this has reduced food production and increased food insecurity (Nevin et al., 2019, Omondi, 2019). In view of this, various plans to raise food production have been put forward by various levels of government and interested parties (Osabohien et al., 2020). Some of these plans aim to

diversify agriculture in order to increase productivity, while others focus on expanding farmers' access to agricultural financing (credit). The implication is that monetary policy has a significant influence on food prices and agricultural productivity, both directly and indirectly. Monetary policy influences food production and prices in several ways, including through the management of inflation, changes to interest rates, stability of currency rates, and the availability of credit (Rivai, 2022). Investment opportunities in the agricultural sector are heavily influenced by interest rates. As a means of controlling inflation, high interest rates can make it difficult for farmers to borrow money to purchase inputs or invest in new agricultural technologies. Interest rate cuts, on the other hand, might boost agricultural output by enticing more borrowing and investment.

Adeyemi and Adunji (2021) note that interest rates and agricultural investment in Nigeria are complicated by systemic issues such as significant default risks and underdeveloped rural lending markets. and monetary policy controls exchange rate policies, which have a significant impact on agricultural productivity. The rising cost of imported inputs, such as machinery and fertiliser, makes it harder for farmers to keep or expand their enterprises when the naira depreciates. Conversely, Ajayi and Ogunmola (2022) argue that a stable exchange rate might encourage sector development by making agricultural exports from Nigeria more competitive and lowering input prices. The agricultural economy of Nigeria is mostly supported by small farms, which contribute the bulk of the country's agricultural produce. Among the many challenges these farmers face are low production, restricted access to loans, and inadequate infrastructure (World Bank, 2021). Thus, as high interest rates are imposed to counteract inflation, smallholder farmers may find it extremely difficult to borrow the money they need to finance input purchases and business expansion (Adetunji & Adeyemi, 2021).

The high cost of borrowing money makes it difficult for farmers to invest in new machinery, use innovative farming techniques, or protect themselves from crop failures and bug infestations. Lack of easily accessible financing compounds already low production levels and makes the agriculture industry even more vulnerable to external shocks. Food insecurity persists because investors are not willing to put money into the industry (World

Bank, 2021). Exchange rate volatility, which is influenced by monetary policy, has a direct impact on agricultural production in Nigeria because the country relies substantially on imported inputs such as fertilisers, equipment, and pesticides (Ajayi & Ogunmola, 2022). As a result of Naira's depreciation, imports have grown more expensive, driving up farmers' output costs. Farmers' diminished ability to maintain productivity and forced output cutbacks due to these elevated input prices further affect the supply of food commodities.

In spite of the relationship between monetary policy, agricultural productivity and food prices, monetary policy does not always address the specific needs of the agricultural sector, particularly those of smallholder farmers, despite its stated objective of promoting macroeconomic stability (Mogaji, 2022). This has aroused many researchers' interest in examining the relationship between monetary policy, agricultural productivity and food prices. However, few studies were documented on monetary policy, agricultural productivity and food prices in Nigeria. Thus, this present study contributes to the scanty literature in this area. To achieve this objective, the specific objectives of the study are to: investigate the impact of monetary policy on agricultural productivity in Nigeria; and examine the impact of monetary policy on food prices in Nigeria. In fulfilling the objectives of the study, the remaining parts of the study are arranged as follows: section two presents the relevant literature, section three shows the methodology, section four discusses the result and section five concludes the study.

Literature Review

Conceptual Review

Friedman (1969) sees monetary policy as the efforts to achieve macroeconomic objectives, such as price stability, robust economic development, and a positive balance of payments, through the manipulation of interest rates and the money supply. The study categorised financial control instruments into two main categories of direct and indirect tools. In a direct monetary management system, the Central Bank establishes interest rate, credit, and monetary targets based on a set of standards to meet the objectives of economic policy. An indirect monetary control system lets the market set interest rates and credit allocation while keeping control over

the monetary base, or bank reserves. Agricultural productivity refers to total crop production; it is the main activity in the agricultural sector, which includes fisheries, forestry, and livestock. Food price is defined as the aggregate consumer price index for food commodities in Nigeria.

Theoretical Review

Monetary Policy Transmission Mechanism

The Monetary Policy Transmission Mechanism (MPTM) is a theoretical framework describing how central banks' policy actions, such as adjustments to interest rates, influence economic stability, growth, aggregate demand, inflation, and output. This mechanism operates through several channels. The Interest Rate Channel refers to changes in policy rates that directly affect borrowing costs, influencing consumer spending and business investment. The credit Channel includes two sub-channels: which are Bank Lending Channel and the Balance sheet channel. The bank-lending channel refers to the adjustments in policy that affect banks' lending capacity while the balance sheet channel refers to changes in asset values that impact borrowers' financial health and access to credit.

Furthermore, Asset Price Channel refers to policy, which influences asset prices, affecting wealth and investment decisions through changes in stock, bond, and real estate values. The Exchange Rate Channel operates in open economies; interest rate changes alter currency value, influencing export competitiveness and trade balance. Expectations Channel has to do with how Central bank signals influence public expectations about inflation and economic conditions, affecting future spending and investment. The MPTM is affected by time lags, both inside and outside due to delays in the policy's recognition, implementation, and eventual impact on economic outcomes. However, criticisms, such as the Lucas Critique, argue that reliance on historical patterns may lead to shifts in behaviour, limiting the mechanism's effectiveness. Globalisation and the rise of non-bank institutions also pose challenges to traditional channels. In summary, MPTM is crucial for understanding central banks' economic influence, and future studies might examine the impact of financial innovation and digital currencies on this transmission process.

The Monetary Policy Transmission Mechanism (MPTM) is a theoretical framework that explains how central banks' policy actions, such as interest rate adjustments, influence economic stability, growth, aggregate demand, inflation, and output (Mishkin, 2001). The mechanism operates through various channels, each linking policy decisions to economic outcomes. One of the primary channels is the Interest Rate Channel, which posits that changes in policy rates directly affect borrowing costs, thereby influencing consumer spending and business investment. When central banks increase interest rates, borrowing costs rise, dampening consumer demand and investment; conversely, rate reductions typically stimulate these activities (Bernanke & Blinder, 1992). The Credit Channel is another critical pathway, divided into two sub-channels: the Bank Lending Channel and the Balance Sheet Channel. The Bank Lending Channel emphasises how monetary policy adjustments influence banks' capacity to lend. For example, contractionary policy can reduce bank reserves, constraining loan supply and economic activity (Bernanke & Gertler, 1995). The Balance Sheet Channel, meanwhile, focuses on how changes in interest rates affect asset values, which influences borrowers' financial health. Declines in asset values weaken borrowers' balance sheets, reducing their ability to access credit, which in turn affects spending and investment (Bernanke et al., 1999). The Asset Price Channel further elaborates on how policy changes influence asset prices— such as stocks, bonds, and real estate, which affect wealth and investment decisions. Lower interest rates generally increase asset prices by reducing discount rates on future income streams, thereby raising household wealth and potentially boosting consumption and investment (Mishkin, 2001).

In open economies, the Exchange Rate Channel describes how interest rate adjustments influence currency values. For instance, when a central bank lowers interest rates, the domestic currency often depreciates, making exports more competitive and improving the trade balance. Conversely, higher rates can appreciate the currency, potentially reducing export demand and aggregate demand overall (Obstfeld & Rogoff, 1995). The Expectations Channel plays a significant role by shaping public perceptions about future economic conditions. Central banks' signals regarding intended policy directions affect expectations of inflation and growth, which, in turn, influence

households and firms' decisions on spending and investment. When the central bank commits to a stable low-rate policy, for example, it may encourage borrowing and investment by reducing future uncertainty (Woodford, 2003).

Time Lags are inherent in the MPTM, affecting both the recognition and implementation of policies as well as their ultimate economic impact. Inside lags reflect the delay in identifying economic conditions and implementing policy responses, while outside lags denote the period between policy actions and their effects on economic outcomes (Mishkin, 1996). Criticisms of the MPTM, particularly the Lucas Critique, suggest that relying on historical patterns may lead to shifts in behaviour that limit the effectiveness of policy actions. The Lucas Critique argues that if agents adjust their expectations based on anticipated policies, the effectiveness of traditional transmission channels may be undermined (Lucas, 1976). Additionally, globalisation and the rise of non-bank financial institutions, such as hedge funds, pose challenges to the conventional channels by altering the flow of capital and credit within economies (Gertler & Karadi, 2011). In conclusion, the MPTM provides essential insights into how central bank policies influence the economy through multiple channels. However, evolving financial innovations and the introduction of digital currencies suggest that future studies could further examine how these developments influence monetary policy transmission, potentially reshaping traditional channels.

Berg et al. (2010) emphasised that interest rates and exchange rate can drive expansion in output if the policy environment allows it. In an ideal world, where interest rates are low and people may borrow money for consumption and production without worrying about going into debt, because it is affordable. The demand for agricultural products may rise as a result of a weakening currency. Interest and exchange rate fluctuations often have an effect on output in the short run.

Fisher Effect

The Fisher Effect hypothesis looks at the connection between nominal interest rates, real interest rates, and inflation. The Fisher Effect states that the nominal interest rate is the sum of the real interest rate and the expected rate of inflation. The Fisher Effect states that while the real interest rate

remains constant, changes in nominal interest rates will accurately reflect changes in expected inflation. If inflation expectations rise due to loose monetary policy, nominal interest rates will rise as predicted by the Fisher Effect. This will reduce agricultural output because of increased nominal interest rates and it makes it unaffordable for farmers to borrow more (Fisher, 1930).

Keynesian Theory

The Keynesian economic theory provides a framework for studying the direct effects of monetary policy on this demand. According to Keynesianism, changes in interest rates, consumption, and investment are all influenced by monetary policy shifts, which in turn influence aggregate demand. If the cost of borrowing money drops, more people may invest in agriculture, which boosts output and reduces food prices. Inadequate infrastructure, instability, and a lack of modern farming practices are non-monetary issues that occasionally limit agricultural productivity in Nigeria. Therefore, monetary policy could not be the sole solution to this problem. The Keynesians' theory places an emphasis on the importance of government infrastructure expenditure, agricultural subsidies, and other demand-side policies, in conjunction with monetary policy, in order to stabilise food prices and boost agricultural output (Keynes, 1936).

Empirical Review

Hezekiah and Enaberue (2024) examined financial decisions influencing Nigeria's agriculture industry from 1981 to 2016 on a quarterly basis. The study focused on livestock, forestry, fisheries, and crop production. The study considered money supply, currency rate, benchmark interest rate, and over-lending. Also considered were other economic activities and pricing trends. Monetary policy shocks affect the agricultural industry through interest rate and liquidity preference channels, but the unanticipated benchmark interest rate tightening did not harm the sector or its subsectors. The study highlights the long-term importance of the foreign exchange rate and money supply. As it was, the money supply channel could not close the agricultural loan benchmark interest rate disparity. The study concluded that if policy rate, credit, and lending rates are raised, Nigeria's agricultural

sector may flourish. Olukoya et al. (2024) examined Nigeria's macroeconomic policies and agricultural production in 2024. This study used the Ordinary Least Square estimate method to examine the relationship between government spending on agriculture, foreign investment in agriculture, currency rate, inflation rate, agriculture loans, and food production. T-test and Fisher F-test of significance supported hypotheses. It was found that there is an increase in Nigeria's agricultural production and a decrease in inflation, albeit it may not be statistically significant or sustainable. Also, interest rates, exchange rates, and food output are positively connected. This means a higher exchange rate will boost local agricultural output. Public and private investments in Nigeria's agriculture sector boost food production and output. Long-term, foreign private investment and government agriculture spending go together. This indicates that the government's budget requires diversification and that foreign investors should leave Nigeria's agricultural industry.

Nadani et al. (2023) used a quantile regression model with monthly data from January 2004 to October 2021 to study Nigeria's monetary policy on food inflation. According to the study, tight monetary policy by the Nigeria's central bank lowers food inflation by 0.41% at the 25th quantile and 0.69 % at the 50th. When the exchange rate declines, food inflation drops to 16% at the 90th quantile from 8.92% at the 25th quantile. All quantiles have impressive real GDP. Finally, the OLS estimate shows oil is considerably and positively valued at the 90th quantile. This paper proposes creative financial methods to improve agricultural product supply chains.

Okidim et al. (2023) examined how stability and investments affected agriculture in Nigeria. Research focused on how investment, monetary policy, policy mix, and fiscal policy affected crop yields. WDI, Index Mundi, and Macrotrends provided 1981–2019 time series data for the research variables. Investigations used the Autoregressive Distributed Lagged Model. According to the unit root test, pre-diagnostic variables were I (1) and 1(0). Investment variables did not show long-run co-integrating linkages, according to the ARDL Bound test. In contrast, policy mix, monetary and fiscal factors did. Based on empirical evidence, government agricultural spending was the only fiscal policy variable that affected agricultural productivity in the short term. Agriculture output is strongly correlated with inflation and

exchange rate. All policy mix components affected agricultural output short-term. Private domestic investment was the only variable that significantly affected agricultural output.

Rivai (2022) examined the effects of macroeconomic policy (i.e. monetary policy) on employment, food inflation, and agricultural growth by analysing to what extent monetary policy is effective in controlling food price inflation, the effect of contractionary monetary policy on the agricultural sector's employment and productivity, and the extent of monetary policy transmission to money market rates and 10-year interest. A factor-augmented vector autoregressive model was used to evaluate agricultural data for Pakistan from 1996 to 2016 and Indonesia from 1995 to 2016 by Bernanke et al. (2005). The study indicated that strict monetary policy increased rural unemployment while balancing food price inflation and agricultural production. Short-term and 10-year interest rates rose due to both nations' contractionary monetary policies.

Asaleye et al. (2021) used structural vector autoregression (SVAR) and dynamic ordinary least squares to study how monetary policy channels affected Nigerian agricultural output. The study's output, employment, and export measures show agricultural success. Credit, interest rates, money, and exchange rates are monetary policy conduits. SVAR variance decomposition shows that monetary policy prediction error shocks affect agricultural performance. The Department of Labour Statistics' long-run equations show that output and money supply are positively correlated, employment and interest rates are negatively correlated, and export and exchange rates are negatively correlated. The study showed that the Nigerian government should explore enhancing agricultural production and employment in addition to balancing the economy through interest rate and money supply manipulation.

Ogah et al. (2021) used annual data from 1981 to 2016 and a vector auto-regressive model with an Augmented Dickey-Fuller unit root test to assess fiscal and monetary policy effects on rice output. All series underwent a Johansen Co-integration test. The results show that rice production is co-integrated with all fiscal and monetary policy instruments. Long-term correlation exists between components and rice output. Interest rates, currency rates, money supply, and state spending affect rice output long-

term with an adjusted R_2 value of 60%. The outcome also revealed slowed interest rates, rice production, and currency rates. Medium-term monetary and fiscal policy changes would equalise rice productivity at 0.365830. Research shows that policy tools alter rice output over time. Based on these findings, the research recommended regulating interest rates to the closest decimal place and implementing a favourable exchange rate. The recommendation is that there should be increased government spending on agriculture and focus on rice cultivation to boost yield.

Arigol et al. (2021) examined Nigeria's agricultural GDP from 1970 to 2018 and how monetary policy affected it. The time series were tested with the Philip Peron unit root and improved Dickey-Fuller tests. Only the liquidity ratio (LIQ) and inflation rate (INF) were stationary. After the initial difference, all variables except CREDIT, DCBN, INT, M2, and MPR were stationary. The study used error correction models (ECM) and co-integration. A 10% long-term inflation rate was statistically significant, whereas a 1% exchange rate and 5% farm loan were positive. Agricultural GDP was positively connected with inflation at 5%, although lending rates, monetary policy rates, and agricultural credit are negatively correlated in the short term. These connections are significant at 1%, 5%, and 10%. The analysis found that short- and long-term economic policy packages should encourage agriculture investment to boost agricultural GDP. A suitable policy package is needed to stabilise inflation.

Ogbuabor et al. (2020) found that monetary policy shocks affected Nigeria's agricultural industry between 1981 Q1 and 2016 Q4. The research used normalised generalised forecast error variance decompositions and order-invariant generalised impulse responses from a VAR model. The study examined four agricultural subsectors: crop production, forestry, fisheries, and livestock. Study variables included interbank call rate, monetary policy rate, broad money supply, and exchange rate. Price levels and other economic indicators were also studied. While interest rates and money demand (credit) indirectly affect the agricultural sector, the results show that unexpected monetary tightening consistently hurt the agricultural sector and its subsectors throughout most of the forecast horizon. Even without these two routes, the exchange rate and monetary policy rate have long-term effects. Agricultural sector monetary policy shocks were rarely

cushioned by the money supply channel. The analysis found that Nigeria's central bank should promote agricultural growth through interest rate, credit, and exchange rate policies.

Awolaja and Okedina (2020) explored how actual exchange rate fluctuations affect Nigerian agricultural output by sector and country. This study examined the short- and long-term asymmetrical links between the real exchange rate and aggregate and sectoral agricultural production using the nonlinear Auto-Regressive Distributed Lag (ARDL) cointegration paradigm. The results show that the real exchange rate affects agriculture production overall and by sector. Real exchange rate appreciation benefits aggregate and sectoral agricultural production more than depreciation over time. Long-term estimates show that agricultural production is more responsive to exchange rate increases than reductions. This empirical analysis shows that a well-planned exchange rate strategy boosts farm growth.

Oboh et al. (2019) studied monetary policy's impact on Nigeria's agriculture business using 1981–2016 annual data. Nigeria's agricultural business employs 60% of its economically active population and 70% of its poorest areas, therefore it has great potential to reduce poverty. In this Autoregressive-Distributed Lag (ARDL) analysis, monetary policy and agricultural value-added variables were found to be linked over time. The results show that currency and inflation rates do not affect agricultural value added over time. However, money supply and maximum lending rate do. Since money supply is crucial to agricultural sector performance, the study suggests an expansionary but non-inflationary monetary strategy to boost value addition in Nigeria's agriculture sector.

Abdulaziz et al. (2019) used quarterly time series data from 2010 to2017 to analyse oil shocks' disproportionate impact on Nigerian food prices. The study used a non-linear autoregressive distributive lag model to examine oil shocks' short- and long-term effects on food prices. Positive oil price shocks affect food prices more than negative ones, according to the research. The paper suggests the government diversify its income sources and improve the agricultural sector. To help the agricultural sector and other economic sectors grow, a group must save and distribute beneficial oil shock funds.

Wagan et al. (2018) examined employment, food inflation, agricultural expansion, and macroeconomic policy. They examined how much monetary

policy can regulate food price increases, how contractionary monetary policy affects agricultural employment and productivity, and how it affects money market rates and 10-year interest rates. This was done using 1995–2016 agricultural data for Pakistan and India and a factor-augmented vector autoregressive model. Strict monetary policy affected agricultural output, food inflation, and rural unemployment, the study showed. Short-term and 10-year interest rates rose due to both nations' contractionary monetary policies. Policymakers should engage with governments to stabilise prices and increase employment through inclusive monetary policy.

Nigerian commercial bank lending is linked to agriculture, according to Agunuwa et al. (2015). Statistics uses Ordinary Least Squares (OLS). The Unit Root Test verified variable stationaryness before employing OLS. The OLS result supported all three assumptions. The t-critical threshold for commercial banks' t-calculated credit is 1.96, whereas 6.28 is higher. Commercial bank loans seem to boost agricultural production. Commercial bank loans have a t-calculated interest rate of -9.38, below the 1.96 t-critical. The relationship between interest rates and agricultural output appears to be inverse. Government expenditure has a t-calculated variable of 3.42, not 1.96. A high positive link between government spending and agricultural output in Nigeria supports the first theory. The study found that Agricultural Credit Guarantee Scheme members should enhance their credit guarantee terms to entice commercial banks to agricultural financing.

Akintunde et al. (2013) examined how the government of Nigeria spent its agriculture budget and how monetary policy instruments increased agricultural GDP. The data came from two CBN statistics bulletins and the National Bureau of Statistics. Data from 1980 to 2012 is analysed using OLS with E-view. The results showed that the Agricultural Credit Guarantee Scheme Fund, GDP from the previous year, and the Consumer Price Index boosted agricultural GDP growth, while interest rates, exchange rates, and government spending on agriculture hurt it. According to the report, rural areas need reliable roads, energy, healthcare, and water, and the government should enhance agriculture funding while strictly monitoring it. The report recommended that the CBN lower the interest rate to single digits to attract investors to the agriculture sector and maintain agricultural GDP development.

Methodology

In order to analyse how monetary policy affected agricultural production and food prices in Nigeria, this study used an ex-post facto research design to gather historical data. One hundred and sixteen observations covering 29 years, from 1995 to 2023, were included in the study. Information was culled from the statistical bulletin published by the Central Bank. The study measured monetary policy using the exchange rate, money supply, and interest rate. Agricultural productivity was captured by the growth of the agricultural sector. Food prices were measured using the consumer price index. Autoregressive distributed lag (ARDL) was the estimating technique utilised. However, these specifications are replicated using different variables as stated in the baseline equations. The model I specified as:

Monetary policy-Agricultural Productivity Relationship

$$agr_t = c_0 + c_1 l\,\text{int}_t + c_2 lexc_t + c_3 lmsp_t + u_t \quad 3.1$$

The ARDL form can be given as:

$$agr_t = b_0 + \sum_{i=1}^{q^1} b_i agr_{t-i} + \sum_{i=1}^{q^2} h_i l\,\text{int}_{t-i} + \sum_{i=1}^{q^3} g_i lexc_{t-i} + \sum_{i=1}^{q^4} f_i lmsp_t + w_t \quad 3.2$$

$$q^1 = q^2 = q^3 = q^4; i = 1, 2, \ldots, q^1$$

Monetary Policy-Food Prices Relationship

$$agr_t = a_0 + a_1 l\,\text{int}_t + a_2 lexc_t + a_3 lmsp_t + e_t \quad 3.3$$

The ARDL form can be given as:

$$lfpr_t = b_0 + \sum_{i=1}^{q^1} b_i lfpr_{t-i} + \sum_{i=1}^{q^2} h_i l\,\text{int}_{t-i} + \sum_{i=1}^{q^3} g_i lexc_{t-i} + \sum_{i=1}^{q^4} f_i lmsp_t + w_t \quad 3.4$$

Where: LFPR represents food price, LINT indicates interest rate, LEXC means exchange rate, LMSP represents money supply and AGR represents agricultural sector growth, q is the lag length, foreign direct investment and inflation are taken for control variables. To estimate the model the study conducted the unit root through the Augmented Dickey Fuller and Philip Peron Methods in order to show order of integration of the variables and determine if the proposed method of estimation was suitable for the analysis.

Result

This section presents the estimation of the model specified in section three and they are discussed in line with previous studies. The Table 1 summarises the descriptive result of the variables of interest.

Table 1: Descriptive Statistics

Statistics	LFPR	LINT	LEXC	LMSP	AGR
Mean	2.000352	1.230617	2.135394	568.1838	0.041052
Median	1.982843	1.233560	2.172060	321.7795	0.030847
Maximum	2.886777	1.403728	2.886330	4632.741	0.435923
Minimum	1.198070	1.055579	1.034528	-721.4217	-0.047131
Std. Dev.	0.430967	0.074679	0.386135	860.8873	0.051489
Skewness	0.195538	-0.430902	-0.885531	2.591560	4.586562
Kurtosis	1.990612	3.264544	3.601073	10.82316	32.72209
Jarque-Bera	5.663726	3.927995	16.90676	421.9859	4676.486
Probability	0.058903	0.140296	0.000213	0.000000	0.000000

Note: LFPR represents food price, LINT indicates interest rate, LEXC means exchange rate, LMSP represents money supply and AGR represents agricultural sector growth.

Source: Author's computation (2024)

The positive mean values of food price, interest rate, exchange rate, money supply, and agricultural sector growth clearly indicate that these variables showed an upward trend during the assessment period. Additionally, the study verifies that the agricultural sector's growth has the lowest range and the lowest standard deviation value, in contrast to the money supply's highest range and largest standard deviation value. The preceding finding suggests that among the variables considered, money supply is the most unpredictable, whereas agriculture sectors development is the least. Interest

rate and exchange rate are negatively skewed, meaning that the variables display large values over a long period of the sample, in contrast to food price, money supply, and agricultural sector growth, which are positively skewed, suggesting that they have large values over a short period. With the exception of food price, all of the variables have kurtosis values more than 3, indicating that they are leptokurtic, or having a tin tail in their distribution pattern, which may indicate the presence of outliers or bigger values. Moreover, the probability values that correspond to the Jarque-Bera statistic when it comes to interest rates and food prices are greater than 5%. This suggests that interest rates and food prices follow a normal distribution pattern, while the Jarque-Bera statistic indicates that exchange rate, money supply, and agricultural sector growth do not conform to normal distribution, as evidenced by their respective probability values. The study proceeds to check the stationarity of the variables used. The result is presented in Table 2.

Table 2: Unit Root

Variables	ADF		PP		Order of Int.
	Level	Fist diff	Level	Fist diff	
AGR	-4.216258 (0.0000)		-5.397284 (0.0001)		**I(0)**
LFPR	0.229944 (0.9980)	-5.470728 (0.0001)	-1.740487 (0.7268)	-9.987835 (0.0000)	**I(1)**
LMSP	1.063293 (0.9999)	-6.991306 (0.0000)	-0.411616 (0.9861)	-13.08294 (0.0000)	**I(1)**
LEXR	-1.232864 (0.6583)	-3.476410 (0.0105)	-1.993509 (0.0000)	-.819268 (0.5984)	**I(1)**
LITR	-3.544130 (0.0398)		-6.162820 (0.0000)		**I(0)**

Source: Author's computation, (2024)

The sequence of integration of each variable is confirmed by doing the unit root test under the Augmented Dickey Fuller and Philip Peron unit root

tests. The series are not stationary, according to the null hypothesis. If the related critical value is greater than 5% in absolute form or if the associated probability value is less than 5% (0.05), the hypotheses are rejected. It is explicit that the associated probability value with respect to Agricultural sector growth and interest rate are lesser than 0.05. This simply implies that agricultural sector growth and interest rate are stationary at level under the ADF and PP methods and this is simply denoted as I(0). In addition, the result shows that food price, money supply and exchange rate are stationary at first difference and this is denoted as I(1) under the ADF and PP methods. Based on the above result, it implies that there is mixed integration among the variable of interest and the method of estimation will be based on the model specification.

In line with the result of the unit root test, the meaningful technique for estimation is the ARDL and Bond test approach to cointegration. This was conducted to achieve the two objectives set for this study which are monetary policy-agricultural sector growth relationship and monetary policy-food price relationship. The results of each objectives are presented in Panel A and B respectively. However, the optimum ARDL model for monetary policy-agricultural sector growth relationship is ARDL with order of 2, 3, 3, 3 and it shows absence of serial correlation and it was stable since the blue line falls in between the red lines under the cursive Ramsey Cussum graph. Also, the optimum ARDL model for monetary policy-agricultural sector growth relationship is ARDL with order of 2, 2, 2, 23 and it shows the absence of serial correlation and it was stable since the blue line falls in between the red lines under the cursive Ramsey Cussum graph. Having confirmed the stability of the ARDL, the study presents the ARDL Bound Test to cointegration in Table 3.

Table 3: Cointegration Bound Test Result

	Panel A: ARDL (2, 3, 3, 3)		Panel B: ARDL (2, 2, 2, 2)	
Test Statistic	Value	K (number of regressors)	Value	K (number of regressors)
F-statistic	5.228683	3	8.696882	3
	Critical value bounds		**Critical value bounds**	
Signif.	I(0)	I(1)	I(0)	I(1)
10%	3.47	4.45	2.37	3.2
5%	4.01	5.07	2.79	3.67
2.5%	4.52	5.62	3.15	4.08
1%	5.17	6.36	3.65	4.66

Source: Author's Computation, (2024)

Panel A's Table 4 shows that the F statistic, at 5.228683, is greater than the 5% lower bound I(0) value of 4.01 and the 5% upper bound I(1) value of 5.07. The F-statistic number is higher than the range of possible values, so this is a positive sign. This indicates that there is a cointegrating relationship between monetary policy and agriculture sector growth, and at a 5% level of significance, the null hypothesis that no level relationship exists is rejected. Furthermore, the F-statistics result under Panel B is 8.696882, which is greater than the lower bound I(0) value of 2.79 and the upper bound I(1) value of 3.67 at 5%. All of this sets the stage for testing the hypothesis that each model's explanatory variable is positively or negatively affected by a collection of variables. Table 4 displays the test results and short-run dynamism.

Table 4: Long-Run Multiplier Effects and Short-Run Dynamism

Long Run Multiplier Effects				
Variable	Panel A		Panel B	
	Coefficient	Prob.	Coefficient	Prob.
LEXC	0.133232	0.0468	1.010313	0.0433
LINT	-0.055825	0.7898	-2.033888	0.3513
LMSP	-1.86E-05	0.3677	0.000420	0.2972
Short Run Dynamism				
D(AGR(-1))	-0.122803	0.2045		
D(LFPR(-1))			0.053135	0.5621
D(LEXC)	0.091242	0.2300	0.032314	0.3029
D(LEXC(-1))	-0.085978	0.2835	-0.049187	0.1099
D(LEXC(-2))	-0.047984	0.5200		
D(LINT)	1.011359	0.0000	0.019851	0.7910
D(LINT(-1))	-0.537822	0.0234	-0.078577	0.3117
D(LINT(-2))	-0.070169	0.7503		
D(LMSP)	-2.47E-06	0.8091	3.10E-06	0.4469
D(LMSP(-1))	6.60E-06	0.5196	-8.99E-07	0.8281
D(LMSP(-2))	1.09E-05	0.2771		
CointEq(-1)*	-0.410398	0.0000	-0.011977	0.0000
Diagnostic Test				
Normality test	948.6921	0.0000	67.1327	0.0000
Serial correlation test	1.101766	0.3365	0.650946	0.4217
Heteroscedasticity Test	1.058181	0.4110	1.413628	0.1607

Source: Author's Computation, (2024)

In Panel A, Table 4 shows the results of short-run and long-run estimations on the relationship between monetary policy and agricultural sector growth. It was revealed that the exchange rate has a positive and significant impact on agricultural sector growth while interest rate and money

supply have negative and insignificant impact on agricultural sector growth. This implies that positive multiplier impacts run from exchange rate to agricultural sector growth in the long-run. Thus, a 1 percent change in the exchange rate induces agricultural sector growth by 13 percent. On the other hand, it was revealed that negative and significant impact run from money supply and interest rate agricultural sector growth in the long run. Therefore, a 1 percent fall in interest rate and money supply leads to 5 percent and 1.86E-03 percent increase in agricultural sector growth. Evidence from the study indicated that agricultural sector growth is mostly driven by exchange rates with a strong magnitude in the long-run rather than interest and money supply.

In the short run, the study revealed that the previous value of agricultural sector growth at lag one, the previous values of exchange rate at lag one, the current value of money supply at lag two and the previous value of interest rate at lag two have a negative and insignificant impact on agricultural sector growth in the short run while the previous value of interest rate has a negative but significant impact on agricultural sector growth in the short run. However, it was revealed that the current value of the exchange rate and previous value of money supply at lag one and two have positive but insignificant impact on agricultural sector growth while the current value of interest rate has positive and significant impact on agricultural sector growth. In addition, the result showed the adjustment parameter of -0.410398 with the probability value of 0 percent. This satisfied the two conditions of error correction term which are: long run influence runs from money supply, interest rate and exchange rate to agricultural sector growth, and 41.04 percent disequilibrium is to be corrected within a year. That is when money supply, interest rate and exchange rate jointly change by 1 percent the agricultural sector growth is adjusted by 41.04 percent. The result revealed that the normality assumption is violated because the associated probability of Jarque bera is less than 0.05. Nonetheless, the associated probability of serial correlation is larger than 0.05 and this implies that the residual of the model is not serially correlated. More so, associated probability value of chi-statistics under the heteroscedasticity shows that the residual is heteroscedastic.

In Panel B, the Table 4 revealed the results of short-run and long-run estimations on the relationship between monetary policy and food price. Evidence from the result showed that exchange rate has positive and significant impact on food price while money supply has positive but insignificant impact on the food price. However, the interest rate has negative and insignificant impact on food price. Evidence from the result indicated that exchange rate is most driven food price compared to interest rate and money supply in the long run. The result of the short run revealed that the previous value on food price, the current value of the exchange rate, the current value of interest rate and the current value of money supply have positive but insignificant impact on food price in the short run. On the other hand, the previous value of exchange rate at lag one, the previous value of interest rate at lag one and the previous value of money supply at lag one have negative but insignificant impact on food price in the short run. Moreover, the result showed the adjustment parameter of —0.011977 with the probability value of 0 percent. This satisfies the two conditions of error correction term, which are: long run influence runs from money supply, interest rate and exchange rate to food price and almost 1.2 percent disequilibrium is to be corrected within a year. That is when money supply, interest rate and exchange rate jointly change by 1 percent the food price is adjusted by 1.2 percent. Evidence from the result showed that the normality assumption is violated because the associated probability of Jarque bera is less than 0.05. However, the associated probability of serial correlation is larger than 0.05 and this implies that the residual of the model is not serially correlated. More so, associated probability value of chi-statistics under the heteroscedasticity shows that the residual is heteroscedastic.

Discussion of Findings

Evidence from the result revealed that exchange rate has positive impact on agricultural productivity in the short-run and long-run. This confirms the findings of Ogbuabor et al. (2020) and the explanation for this is that depreciation in Nigeria currency may lead to an increase in agricultural export and this can increase agricultural productivity. It was shown from the estimation that interest rate has negative impact on agricultural productivity in the long-run but it was found that interest rate has positive

impact on agricultural productivity in the short-run. The explanation for this is that higher interest rate raises the cost of borrowings for farmers and this affects their investments in the agricultural sector and this invariably affects productivity. It was explicit from the estimation that the money supply has negative impact on agricultural productivity in the short-run and long-run and this is in line with the findings of Adongo et al. (2020), Hezekiah and Enaberue (2024), among others and this implies that increase in money supply without corresponding growth in agricultural investment can lead to inflationary pressure which affects agricultural productivity negatively.

Evidence from the result revealed that exchange rate has positive impact on food prices in the short-run and long-run. The explanation for this is that an increase in exchange rate can lead to an increase in the cost of production for local farmers and this can increase food prices. It was shown from the estimation that interest rate has negative impact on food prices in the long-run and this conforms to the findings of Rivai (2022) but it was found that interest rate has positive impact on food prices in the short run and conforms to the findings of Olukoya et al (2024). It was explicit from the estimation that the money supply has positive impact on food prices in the short-run and long-run. This implies that an increase in money supply can lead to high food prices due to inflationary pressure.

Conclusion and Recommendations

Evidence from the result revealed that exchange rate has positive impact on agricultural productivity and food prices in Nigeria in the short-run and long-run. It was shown from the estimation that interest rate has negative impact on agricultural productivity and food prices in Nigeria in the long-run but it was found that interest rate has positive impact on agricultural sector growth in the short-run. It was explicit from the estimation that the money supply has negative impact on agricultural productivity in the short-run and long-run. However, it was explicit from the estimation that the money supply has a positive impact on food prices in the short-run and long-run.

The study concluded that an increase in exchange rate promotes export-oriented agricultural products but tend to have pass-through effect on imported food items or production input. It was concluded that high interest

discourages investment in agricultural technology due to increase in operating cost and this negatively affects the agricultural productivity and increases food prices. Increase in money supply without corresponding growth in agricultural investment affects the productivity of agricultural sector and increases food prices. In view of this, the policy makers should put in place policy measures to reduce exchange rate fluctuations (such as adequate foreign reserves, limitations on sales of foreign currency etc.) and predictable environment for farmers to invest in productivity-enhancing practices. The government should introduce low-interst loans for farmers and increase the credit availability targeted at the agricultural sector and the use of price control during the periods of inflation. More so, part of the money supply should be targeted at real sector productivity, particularly the agriculture sector to avoid inflationary pressures that hinder food prices and agricultural productivity. One of the limitations of the study is that it only focuses on direct impact of monetary policy on agricultural productivity and food prices without considering those factors that may influence the direct impact of monetary policy on agricultural productivity and food prices such as environmental factors, social factors, among others. In view of this, other studies may extend the frontier to moderating impact of social factors, environmental factors on the relationship between monetary policy and agricultural productivity and food prices.

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